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ByLabel: A Boundary Based Semi-Automatic Image Annotation Tool

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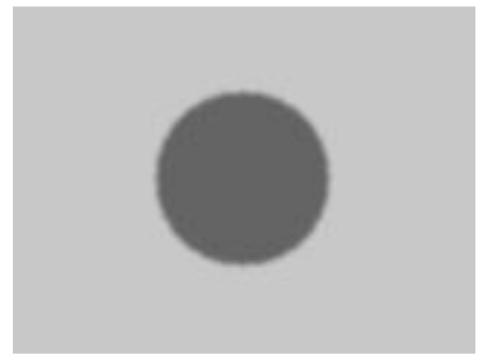
1. Introduction:

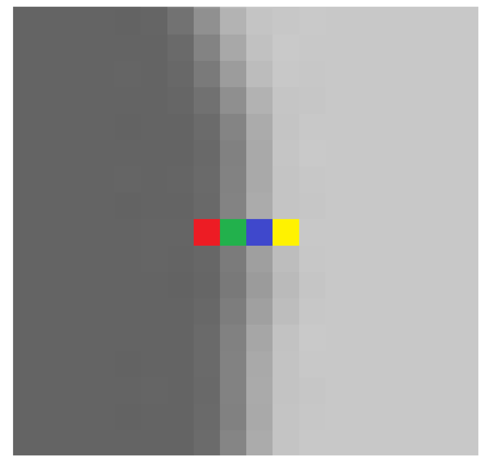
- In image segmentation and visual tracking, well annotated image and video ground truth are essential for performance evaluation and comparison of methods.
- Image annotation based on bounding boxes, coarse polygons and region masks (obtained from graph cuts or level set) are either inaccurate or less flexible.
- How to acquire accurate image annotations with light human workload still remains an open problem.
- In this paper, we develop a boundary based method for accurate image annotating. This tool outperforms other similar polygon-based methods by solving following problems.

(1). Sampling problem: Many control points are required to describe smoothed and complex curves.



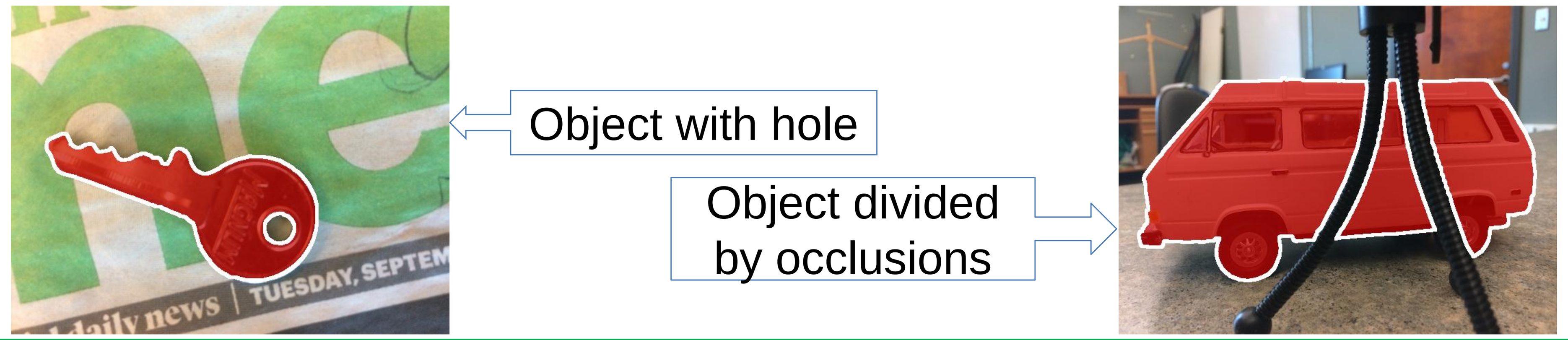
- ✓ To describe the given circle as accurately as possible, many control points have to be selected.
- ✓ That would be a very heavy work when annotating similar or even complex targets.

(2). Locating problem: Accurately locating these control points are difficult.



- ✓ Red, green, blue and yellow pixels are possible control points.
- ✓ Users have to make a decision of picking which one as the control point based on their vision and intuition.
- ✓ Many times of decision making are excruciating.

(3). Description problem: It is hard to describe objects with holes and objects divided by occlusions.



2. Our Solution:

The workflow of our method is illustrated as follow:

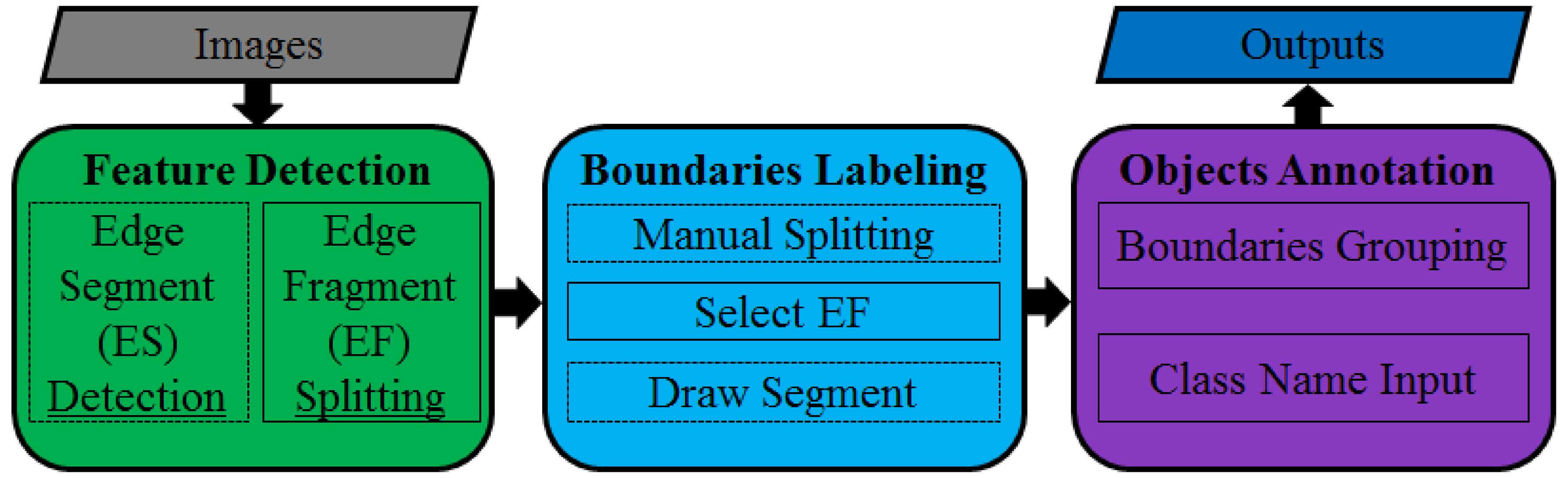


Fig. 4 workflow of our method

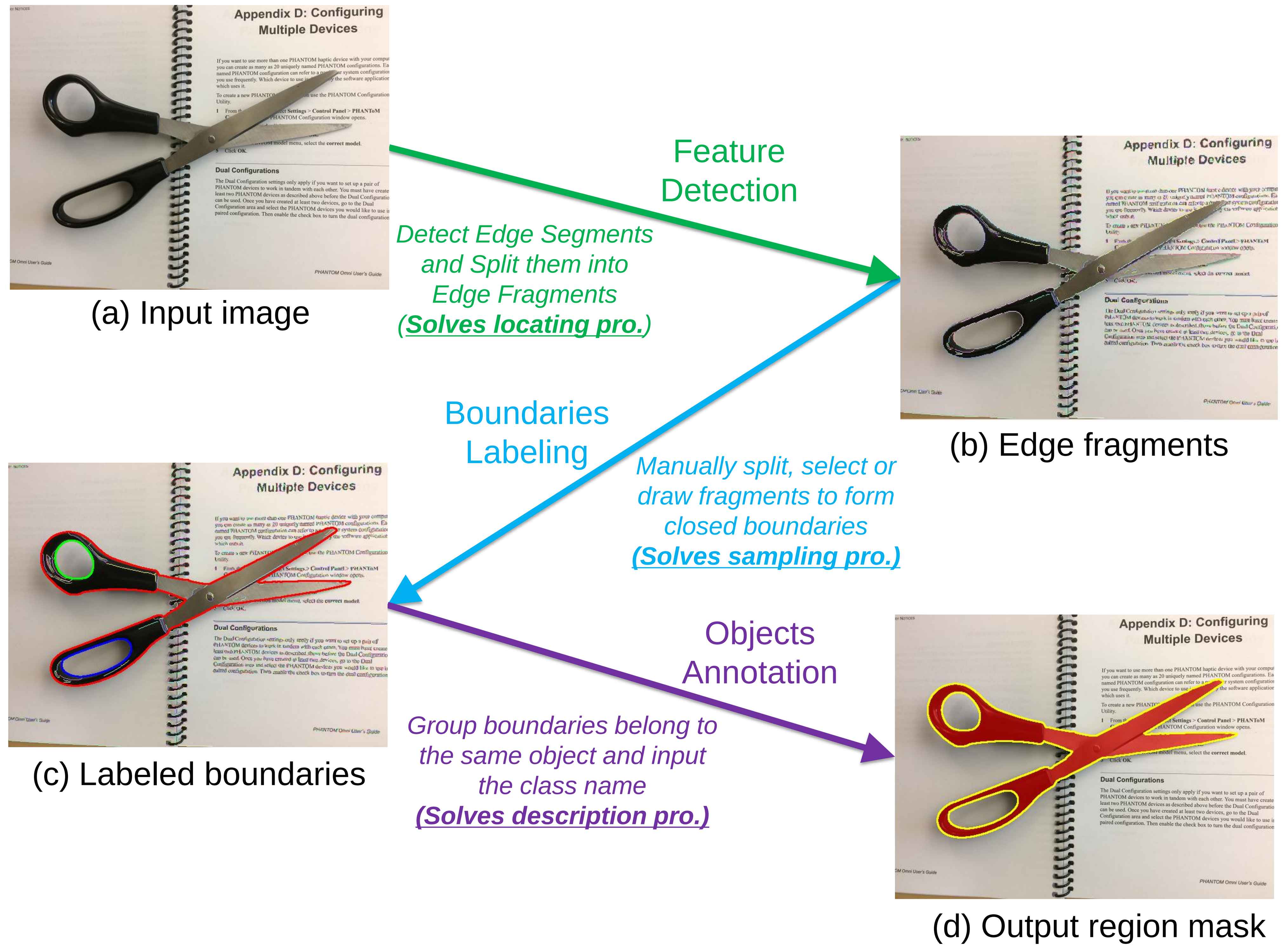


Fig. 5. Annotate an object step by step

Code: http://webdocs.cs.ualberta.ca/~vis/bylabel/

3. Results:

We evaluated our method by asking ten volunteers to annotate 15 typical images using our tool **ByLabel** and LabelMe. The results of clicks, time and error are shown as in Tab. 1, Tab. 2 and Tab. 3 respectively.

Table. 1. Average Clicks

Image	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	Average
LabelMe	5	9	13	35	123	37	28	45	38	51	98	73	129	147	177	**67**
Ours	5	5	4	3	21	13	2	11	23	11	35	16	29	37	62	**18**

Table. 2. Average Time Costs (s)

Image	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	Average
LabelMe	9.61	14.80	18.80	37.85	113.71	44.13	32.08	52.63	49.62	47.80	90.71	74.56	104.79	145.52	144.39	**65.04**
Ours	4.51	4.26	4.01	2.56	23.25	20.03	2.60	13.49	28.19	12.26	64.30	31.02	47.07	62.76	107.62	**28.53**

Table. 3. Average Error (pixel)

Image	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	Average
LabelMe	1.23	1.35	1.50	1.35	1.08	1.21	1.09	0.78	0.73	0.91	0.97	1.25	1.05	0.92	1.02	**1.10**
Ours	0.50	0.74	0.86	0.64	0.67	0.14	0.00	0.01	0.04	0.02	0.16	0.22	0.09	0.03	0.37	**0.30**

Other typical annotation results are shown as follows:

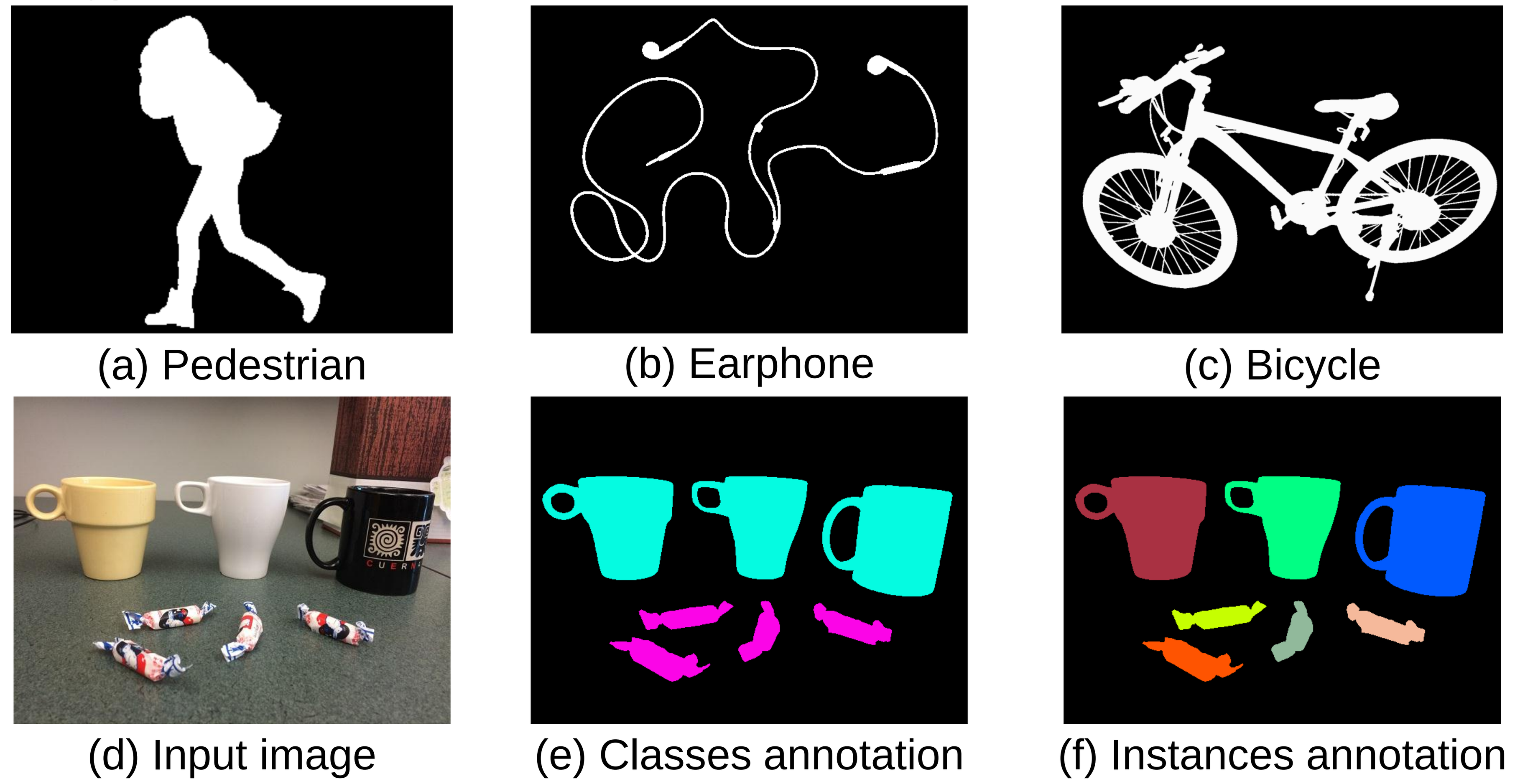


Fig. 6. Typical annotation results

4. Conclusions:

- We develop a novel semi-automatic boundary based image annotation tool, **ByLabel**.
- **ByLabel** introduces edge detection and splitting algorithms to assist annotation, which greatly improves the annotation efficiency and accuracy.
- Additionally, **ByLabel** can also be used to annotate video streams frame by frame.